

**REMARKS**

By this response, claims 23, 41, 43-45 and 47 have been amended. Claim 23 has been amended to depend from claim 20. Claim 41 has been amended without narrowing its scope. Claims 43-45 have been amended to change the term "powder" to "powder particles" to provide strict antecedent basis. Claim 47 has been amended for clarification without narrowing its scope. Claims 20-48 are pending.

Reconsideration and reexamination are respectfully requested in light of the following remarks.

**Rejection Under 35 U.S.C. § 103**

Claims 20-48 stand rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 5,217,683 to Causton. The rejection is respectfully traversed.

Claim 20 recites a process for preparing high density green compacts, which comprises "(a) providing an iron or iron-based powder wherein less than about 5% of the iron-based powder particles have a size below 45  $\mu$ m; (b) uniaxially compacting the powder in a die at a compaction pressure of at least about 800 MPa; and (c) ejecting the green body from the die" (emphasis added). Causton fails to suggest the claimed process for the following reasons.

The Office Action acknowledges that Causton fails to disclose the features of "providing an iron or iron-based powder wherein less than about 5% of the iron-based powder particles have a size below 45  $\mu$ m" and "uniaxially compacting the powder in a die at a compaction pressure of at least about 800 MPa" (emphasis added). However, the Office Action asserts that Causton discloses examples of several particle size ranges that fall in the claimed size ranges, and further that these

ranges, which allegedly overlap or fall within the claimed range establish, a *prima facie* case of obviousness. It also asserted in the Office Action that there has been no showing of unexpected results occurring as a result of the selected claimed ranges as compared to Causton's ranges.

For the following reasons, Applicants respectfully disagree with these assertions and submit that Causton would not have rendered obvious the claimed subject matter.

Particularly, Causton discloses a steel powder composition that is an admixture of two different pre-alloyed iron-based powders. As described at column 3, lines 47-62 of Causton, the first pre-alloyed powder component of the composition contains molybdenum and has a maximum particle size of about 250 microns, more preferably about 212 microns, most preferably about 150 microns, and a preferred average particle size of about 70-100 microns. Causton does not disclose that these first pre-alloyed powders contain a particular amount of particles having a size of less than 45 microns.

However, Causton does disclose that the most-preferred molybdenum-containing iron-based powder for the first powder component is ANCORSTEEL 85 HP. To establish its composition, Applicants have attached a data sheet for ANCORSTEEL 85 HP powder. As shown on page 1 of the data sheet, ANCORSTEEL 85 HP powder has the following particle size distribution (w/o): 20% at -45 microns, 70% at -150/+45 microns, 10% at -25-/150 microns, and a trace at +250 microns. Thus, Causton's most preferred first pre-alloyed powder component is different from the iron or iron-based powder recited in claim 1 with respect to its content of particles having a size of less than 45 microns.

Causton discloses that the second pre-alloyed powder component has a different composition than the first pre-alloyed powder and has a maximum particle size of about 25 microns, and 90% by weight of the particles have a size of 20 microns or below (column 4, lines 52-58).

Thus, in contrast to Causton's most preferred ANCORSTEEL 85 HP powder, the claimed process uses an iron or iron-based powder wherein less than about 5% of the iron-based particles have a size below 45 microns.

Moreover, in Causton's admixture of two pre-alloyed powders of different compositions containing the most preferred ANCORSTEEL 85 HP powder and the second pre-alloyed powder, the second pre-alloyed powder affects the weight percentage of particles having a size of less than 45 microns contained in the admixture.

Applicants further submit that Causton does not suggest modifying the steel powder composition to result in the iron or iron-based powder recited in claim 1.

Furthermore, Causton discloses a compaction pressure of about 40 tons/in<sup>2</sup> for the admixture. Causton does not suggest modifying the method of making sintered steel parts to use an iron or iron-based powder, and a compaction pressure of at least about 800 MPa, as recited in claim 1.

For at least these reasons, Causton fails to support the alleged *prima facie* case of obviousness.

Moreover, the specification provides comparative test results that demonstrate unexpected results that can be provided by embodiments of the claimed process, which use "coarse" powder and a compaction pressure of at least about 800 MPa.

Particularly, as explained at page 2, lines 6-14 of the present specification, the inventors unexpectedly determined that high density green compacts can be produced by using the recited powder wherein less than about 5% of the powder particles have a size below 45  $\mu\text{m}$ , i.e., exemplary "coarse" particles, and a compaction pressure of at least about 800 MPa, which is an exemplary "high" compaction pressure. This finding was unexpected in light of problems that occurred when attempts were made to compact fine particles to high densities.

Unexpected results provided by the claimed process are demonstrated by the test results provided in Examples 1 and 2. In Example 1 described at pages 6-7 of the present specification, two different iron-based powder compositions according to the claimed process were compared with a standard iron-based powder composition. All three compositions were produced with Astaloy Mo, and graphite and a lubricant were added to the compositions. For one of the powder compositions, particles of the Astaloy Mo with a diameter less than 45 microns were removed (" +45 micron powder"). For another powder composition, particles of Astaloy Mo having a size of less than 212 microns were removed (" +212 micron powder"). Fig. 1-1 shows the relationship between green density (GD) and compaction pressure for the three powders. A clear density increase at all compaction pressures was obtained with the +212 micron powder.

Fig. 1-2 shows the relationship between the ejection force ( $F_e$ ) and compaction pressure. As shown, the force needed for ejection of the compacts produced with the +212 micron powder was considerably reduced compared with the ejection force needed for compacts produced from the standard iron-based powder composition including about 20% of the particles sized less than 45 microns.

Moreover, the ejection force decreased with increasing compaction pressure, which is opposite to the standard composition. The ejection force needed for compacts produced from the +45 micron powder was also reduced in comparison with that of the standard powder.

The compacts obtained by compacting the standard powder at a pressure above 700 MPa also had deteriorated surfaces. In contrast, the compacts obtained when the +45 micron powder was compacted at a pressure above 700 MPa had a more desirable surface. The test results demonstrate that components without deteriorated surfaces can be obtained by the reduction of, or elimination of, particles smaller than 45 microns.

Example 2 is described at page 7 of the present specification. As shown in Figs. 2-1 and 2-2, respectively, higher green densities and lower ejection forces were obtained using the +45 micron powder than with the powder composition containing the standard powder. Also, components produced from the standard powder had deteriorated surfaces at all compaction pressures.

Applicants submit that the test results provided in the specification are sufficient to rebut the alleged *prima facie* case of obviousness regarding the process recited in claim 20. Thus, claim 20 is patentable over Causton.

Dependent claims 21-40 and 48 are also patentable over Causton for at least the same reasons as those discussed regarding claim 20.

Independent claim 41 recites "a powder composition comprising an iron or iron-based powder wherein less than about 5% of the powder particles have a size below 45  $\mu$ m; and 0.1-1.0% by weight of graphite" (emphasis added). Causton also

fails to suggest the powder composition of claim 41. Accordingly, claim 41 is also patentable over Causton.

Dependent claims 42-47 are also patentable over Causton for at least the same reasons as those discussed regarding claim 41.

Therefore, withdrawal of the rejection is respectfully requested.

**Conclusion**

For the foregoing reasons, allowance of the application is respectfully requested. Should the Examiner have any questions concerning this response, Applicants' undersigned representative can be reached at the telephone number given below.

Respectfully submitted,

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